ZOOLOGIA 37: e36026
ISSN 1984-4689 (online)
zoologia.pensoft.net

RESEARCH ARTICLE

Reproductive parameters of the Chestnut-capped Blackbird, *Chrysomus ruficapilus* (Passeriformes: Icteridae), in a natural wetland from southeastern Brazil

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http://zoobank.org/E7163EF0-6B9B-45C1-8EDC-C82FCE2AA10B

ABSTRACT. The Chestnut-capped Blackbird, *Chrysomus ruficapilus* (Vieillot, 1819), is a common bird species in flooded areas of South America. Data on its reproductive parameters have been reported mainly for rice paddies from Uruguay and southern Brazil, where reproductive phenology might have been influenced by the chronology of agricultural activities. Here we provide reproductive data for a population in a natural marshland from São Paulo state, southeastern Brazil. A total of 45 active nests were monitored between December 2017 and April 2018. Clutch size was 2.8 ± 0.44. Incubation and nestling periods were respectively 11.8 ± 0.39, and 12.3 ± 0.75 days, and overall nesting success was 65%. The reproductive season lasted about five months, which is longer than that observed in rice paddies from southern Brazil. This suggests that the reproductive phenology has been underestimated before. Although clutch sizes were bigger in our study population than that from rice paddies from southern Brazil, nest survival was higher in the artificial habitat, suggesting that the Chestnut-capped Blackbird can obtain benefits from nesting in artificial habitats.

KEY WORDS. Breeding behavior, icteridae, marshland, nest survival.

The Chestnut-capped Blackbird, *Chrysomus ruficapilus* (Vieillot, 1819), is widely distributed in South America, inhabiting wetlands from French Guiana south to Paraguay, Uruguay and northern Argentina, including most of Brazil, except for parts of the Amazon Basin (Ridgely and Tudor 1994). This species is gregarious throughout the year (Ridgely and Tudor 1994, Fallavena 1988), and during the reproductive period it forms smaller groups that are easily observed in natural marshes or in artificial wetlands, such as wet pasturelands and agricultural fields, being especially common in rice plantations (Klimaitis 1973, Fallavena 1988, Cirne and Lopez-Iborra 2005). Nests are deep open-cups built in the aquatic vegetation, and the first descriptions of the nests, eggs, and nestlings were provided by a study in a natural marsh from Montevideo, Uruguay (Klimaitis 1973). Nests, eggs, and nestling characteristics; mode and clutch sizes for 62 nests, and incubation periods for two nests were also reported by Fallavena (1988), who studied this species in marshes close to rice plantations in the state of Rio Grande do Sul, Brazil. The most complete study on the reproductive biology of the Chestnut-capped Blackbird was conducted by Cirne and Lopez-Iborra (2005), also in this case in rice plantations from Rio Grande do Sul state, Brazil. The authors provided detailed data on clutch sizes, incubation, nestling periods, and nesting success.

Herein we add new knowledge on the reproductive parameters of the Chestnut-capped Blackbird by presenting detailed information obtained in a natural marsh from state of São Paulo, southeastern Brazil. Specifically, we provide the first information on the breeding phenology in a natural nesting site, and comparisons with data obtained in rice paddies from southern Brazil. Additionally, we addressed for the first time the uncertainties related to incubation period estimation caused by variations in incubation initiations by different females.

MATERIAL AND METHODS

The study was conducted in a perennial lake with approximately 45 ha of water surface, located in a private farm in the municipality of Santa Bárbara d'Oeste (25°51'13" S; 47°26'15"W; elevation 590-610 m), in the interior of the state of São Paulo, Brazil. The region is characterized by a mesothermal climate with annual precipitation around 1,400 mm and an average temperature of 23 °C (18-28 °C) (Alvares et al. 2013). The lake is about 0.3 to 1.0 m deep, which allows the growing of abundant emergent vegetation, especially species such as *Eleocharis* sp., *Cyperus* sp., and *Rhynchospora corymbosa* (L.), and to a lesser extent, *Typha angustifolia* L. (Fig. 1). The lakeshores are surrounded by a 50 to 150 m stripe of open wet meadows where the grass *Andropogon bicornis* L. and other herbaceous plants predominate. Further, native trees in mid-successional stage form a buffer zone of about 150 m surrounding this humid area, although the whole complex is imbedded in a matrix of sugar cane plantations.

Figure 1. Nesting site of *Chrysomus ruficapillus*. Study area with high density of *Rhynchospora corymbosa* (L.), emergent plant preferentially used for nest building. Photo: MC Costa.

We conducted nest searches throughout the study area at least three times per week during the breeding season from November 2017 to April 2018. Nests were located following individuals that were carrying nest material, and all the nests were checked every 1–2 days.

The incubation period was measured from the first day of incubation until the day before hatching, and nestling period was defined from hatching day to the day before they left the nest (Francisco 2006, Davanço et al. 2013). To determine the beginning of the incubation period, we performed daily 1-hour observation sessions during the laying period (06:00–09:00 am) and we also checked by hand the temperature of the eggs. We have assumed that the first eggs to be laid were also the first to hatch (Davanço et al. 2013). Clutch sizes and clutch initiation dates were obtained only from nests followed from construction stage, in which we could observe the laying of the first and of the subsequent eggs. We assumed that nest predation occurred when eggs or nestlings younger than fledging age disappeared from the nest, and abandonment was considered when adults were not present in the territory for more than three days and eggs were cold or nestlings were dead. Nesting success (probability of survival) was estimated using the method of Mayfield (1961) for the whole nesting cycle and for incubation and nestling periods separately. It estimates the probability of success from the daily survival rate raised to the power of the length of the nesting cycle. Partial losses of broods were not considered as nest predation. Clutch sizes were compared with literature data from other populations using Mann-Whitney U-test in R (R Core Team 2017).

RESULTS

During the breeding season, we found and monitored 45 active nests of the Chestnut-capped Blackbird. The first nesting activity was represented by a nest with eggs that was found on December 4th, 2017, and the last activity was recorded on April 2nd, 2018 (the last nestlings in a nest). A peak of clutch initiations and of active nests was recorded in January (Fig. 2). Of the 45 active nests, 43 were built on *R. corymbosa* (Fig. 3), one on *Eleocharis* sp. and one on *T. angustifolia*.

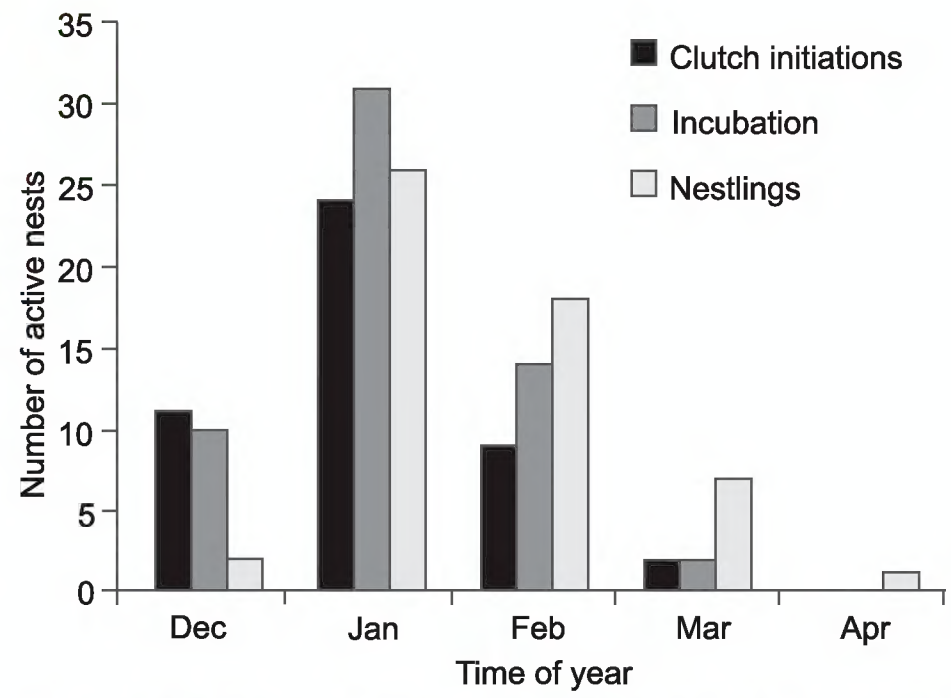

Figure 2. Numbers of active nests (incubation and nestling stages) of *Chrysomus ruficapilus* for the reproductive season of 2017/2018.

The mean clutch size was 2.8 eggs ± 0.44 (N = 45 nests), being one nest with one egg, six nests with two eggs, and 38 nests containing three eggs. Eggs were invariably laid on consecutive days. During nest checking, only females were observed incubating the eggs and incubation was observed to start the day the female laid the first (N = 2 nests), second (N = 6 nests),

Figure 3-6. Nests, eggs and nestling of *Chrysomus ruficapillus*. (3) Side view of a nest. (4) Details of the nest and egg. (5) Details of a newly born nestling and two eggs. (6) Details of two nestlings with 6-7 days. Photos: MC Costa and CAB Medolago.

or third egg (N = 1 nest). Incubation periods were 11 (N = 4 eggs) or 12 days (N = 19 eggs), averaging 11.8 ± 0.39 days (N = 9 nests). Nestling stage lasted 11 to 13 days (12.3 ± 0.75, N = 13 young from nine different nests). Nests, eggs and nestlings are depicted in Figs 4–6.

Interspecific parasitism by Shiny-Cowbirds, *Molothrus bonariensis* (Gmelin, 1789), was not observed in our study population (see for instance Blanco 1995, Lyon 1997). During the incubation stage, of 45 nests, one was abandoned, and one fell down after heavy rain. During the nestling stage, eight out of 43 nests were considered depredated (22%), and in two nests the nestlings were found dead for unknown reasons. Estimated nest survival probability was 95% for the incubation stage (474 nest days, *N* = 43 nests), and 65% for the nestling stage (382 nest days, N = 39 nests). Overall nesting success, from egg-laying to fledging, was 65% (832 nest days, N = 41 nests).

Clutch sizes of the Chestnut-capped Blackbird differed significantly between our study population in a tropical natural wetland and that from rice paddies from subtropical southern Brazil (2.5 ± 0.85, N = 48; Cirne and Lopez-Iborra 2005) (U = 815, p = 0.015).

DISCUSSION

The breeding season of the Chestnut-capped Blackbird in our study population lasted five months, from December (first nesting activity) to early April, thus was the longest recorded for the species (Klimaitis 1973, Fallavena 1988, Cirne and Lopez-Iborra 2005). Notably, the above studies were conducted in areas close or within rice plantations, and they were commonly concentrated in only two months. Previous studies have noted a synchronism between rice crops and the Chestnut-capped Blackbird reproduction. In these cases the beginning of nest building depended on the flowering of the rice plants, because the stems of the flowers are more rigid than the leaves, offering better support to the nests. The time between stem formation and harvesting is approximately two months, and as a consequence the clutches started during the fifth week after stem formation

could not complete their cycles successfully (Fallavena 1988, Cirne and Lopez-Iborra 2005). Our data reinforces the evidence that breeding season durations may have been underestimated in these previous works. *Rhyncospora corymbosa* is the main plant used by the Chestnut-capped Blackbird to build nests in our study area and the nests were often built in the leaves, not depending on the flower stems as in rice crops.

The observation that females of the Chestnut-capped Blackbird can start incubating after laying the first, second, or the third egg is important because if not taken into account, it can introduce errors in incubation period estimates. In previous works, these parameters were measured by counting from the laying of the first egg to hatching of the first young for the incubation period, and from the first hatching to fledging for the nestling period (Cirne and Lopez-Iborra 2005). When we adjusted our data to this methodology, our incubation period was 12.6 ± 0.73 days (range 12-14), and that obtained by Cirne and Lopez-Iborra (2005) in the state of Rio Grande do Sul was 12.9 ± 1.14 days. Although these averages are similar, the variation of the incubation periods stated in the literature, which range from 10 to 13 days (Jamarillo and Burke 1999, Cirne and Lopez-Iborra 2005), might be an effect of the day each female started incubation, rather than a natural variation in incubation times between eggs.

In our study area, there was no interspecific nest parasitism, as also observed in the studies performed in Uruguay and Rio Grande do Sul, Brazil (Klimaitis 1973, Cirne and Lopez-Iborra 2005). However, in some localities (Argentine), interspecific nest parasitism by Shiny-Cowbirds reached rates of 50% (Blanco 1995, Lyon 1997). Apparent nest predation rates, which is a direct estimate without the use of Mayfield's (1961) nest-days correction, were also highly variable, ranging from 7% (Cirne and Lopez-Iborra 2005) to 33% (Fallavena 1988), and in our study area we obtained an intermediate nest predation level (22%). The Chestnut-capped Blackbird is one of the few Neotropical bird species for which reproductive data from multiple populations are available in the literature (but see Davanço et al. 2013), and comparisons revealed that important parameters related to annual fecundity can vary among populations, likely due to habitat characteristics.

The larger clutch sizes found in our study population in relation to the study of Cirne and Lopez-Iborra (2005) in the state of Rio Grande do Sul do not corroborate the prediction of larger clutch sizes in higher latitudes (Moreau 1944, Lack 1947, Skutch 1949), a pattern commonly found in northern temperate hemisphere (Dhondt et al. 2002, Cooper et al. 2005). However, nest survival seemed to be higher in the artificial habitat (Cirne and Lopez-Iborra 2005). Not rarely, birds are attracted to artificial habitats for nesting, which often can result in increased nesting success as certain predators can be inhibited by human activities (Møller 2010). We are unaware, however, if reduced breeding season and clutch sizes in this type of artificial habitat can counteract the increased nest survival, which might require further investigation.

ACKNOWLEDGMENTS

This study was supported by the Conselho Nacional de Desenvolvimento Científico e Tecnológico (CNPq) of the Ministry of Science, Technology and Innovation of Brazil (Scholarship Process #141072/2015-6), conducted under SISBIO permit #60760, and CEMAVE permit #4269/1. All procedures were in accordance with the ethical standards of the ethics committee on the use of animals (CEUA) at UFSCar, Brazil (#3798081117). We are also especially grateful to Nova Amaralina Propriedades Agrícolas/RADAR/COSAN for permits to allow fieldwork.

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Submitted: May 9, 2019
Accepted: October 24, 2019
Available online: April 7, 2020
Editorial responsibility: Claudia Hermes

Author Contributions: MCC, CABM, AM, and MRF designed and conducted the experiments, analyzed the data and wrote the paper.
Competing Interests: The authors have declared that no competing interests exist.
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